Influence of anxiety on the muscles strength in the leg after ACL reconstruction

Wpływ nasilenia lęku jako cechy na siłę mięśni pacjentów poddanych operacyjnej rekonstrukcji więzadła krzyżowego przedniego stawu kolanowego

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Key words
lower limb, anterior cruciate ligament, ACL, anxiety, muscles, force, rehabilitation

Abstract
Background: The rupture of the anterior cruciate ligament (ACL) constitutes the third most frequent ligament injury of the knee joint. The approach involves its reconstruction and post-operational rehabilitation. The results of treatment are evaluated on the basis of, among other things, orthopaedic tests, tests of muscle strength and circumference measurements when compared to the other leg. The clinical state of the ligament is not always in accordance with the patient's perceptions as to their state of health. An influence on the self evaluation of health on the part of the patient is brought about by, among other things, an intensification in fear and anxiety.
Objective: An evaluation of the influence of a predisposition for an anxiety reaction on the effectiveness of rehabilitation, evaluated in relation to the measurement of muscle strength, following operational treatment of the injured ACL.
Materials and Methods: 201 patients (113 women and 88 men) were tested who had a diagnosed of the ACL injury. All the patients were subjected to a reconstruction of the ACL as well as a period of six months of rehabilitation treatment. The STAI questionnaire was used in the evaluation of the trait-anxiety prior to the operational procedure, while twice a dynamometer was used in the testing of muscle strength (a week before and six months after the operation).
Results: Those patients displaying a small intensification in trait-anxiety (lower than 3.5) significantly more often than those patients displaying a large intensification in trait-anxiety (over 7.5) gained increased muscle strength following rehabilitation of the hip joint adductor and the extensors of the knee joint, as well as an improvement in the leg press test of the lower limb operated on.
Conclusions: An increased predisposition for an anxiety reaction may be the reason for poorer rehabilitation results in patients following an operational reconstruction of the ACL. It may be necessary in the case of patients undergoing rehabilitation after an operational reconstruction of the ACL and who display an intensive anxiety of the said to consider the application of an individual programme of rehabilitation, one incorporating elements of psychotherapy.

Słowa kluczowe
kończyna dolna, więzadło krzyżowe przednie, lęk, siła, mięśnie, rehabilitacja

Streszczenie
Założenia: Izolowane zerwanie więzadła krzyżowego przedniego kolana ACL jest trzecim co do częstości urazem więzadłowym stawu kolanowego. Postępowanie obejmuje rekonstrukcję i rehabilitację pooperacyjną. Wyniki leczenia ocenia się m.in. na podstawie testów ortopedycznych, badań siły mięśniowej i pomiarów obwodów, porównywanych do nogi przeciwnej. Stan kliniczny operowanego więzadła nie zawsze jest zbieżny z odczuciami pacjenta co do własnego zdrowia. Wpływ na samoocenę zdrowia przez pacjenta i przebieg rehabilitacji ma między innymi nasilenie lęku.
Cel: Ocena wpływu predyspozycji do reagowania lękiem na skuteczność rehabilitacji, ocenianej w oparciu o pomiary siły mięśni, po operacyjnym leczeniu przerwanego więzadła krzyżowego przedniego kolana.

The individual division on this paper was as follows: A – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

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Materiał i metoda: Badano 201 pacjentów z rozpoznanym zerwaniem więzadła krzyżowego przedniego kolana (113 kobiet i 88 mężczyzn). Wszyscy pacjenci zostali poddani rekonstrukcji więzadła krzyżowego przedniego oraz sześciomiesięcznemu leczeniu rehabilitacyjnemu. Do oceny nasilenia lęku jako cechy badanego przed zabiegiem operacyjnym zastosowano Kwestionariusz STAI, a do dwukrotnego badania siły mięśni (tydzień przed i po 6 miesiącach od operacji) zastosowano dynamometr.
Wyniki: Badani wykazujący małe nasilenie lęku-cechy (poniżej 3,5 stena) istotnie częściej niż badani wykazujący duże nasilenie lęku-cechy (powyżej 7,5 stena) uzyskiwali po rehabilitacji zwiększenie siły mięśni przywodzicieli stawu biodrowego i prostowników stawu kolanowego, oraz poprawę w teście leg press operowanej kończyny dolnej.
Wnioski: Zwiększona predyspozycja do reagowania lękiem może być przyczyną gorszych wyników rehabilitacji pacjentów po operacyjnej rekonstrukcji więzadła krzyżowego przedniego. W przypadku pacjentów o nasilonym lęku, rehabilitowanych po operacyjnej rekonstrukcji więzadła krzyżowego przedniego, należy rozważyć zastosowanie indywidualnego programu rehabilitacji, uwzględniającego psychoterapię.

INTRODUCTION

Daily life creates an array of unavoidable situations in which man feels threatened, experiences anx-iety and in which he has to cope. This results from the fact that small stressors, as a consequence of their subliminal character, act subconsciously and the reaction to them is automatic. In the case of strong new stimuli we are protected, due to the autonomic system's 'fight or flight' reaction, by an ability developed through years of experience to react to a fear; something defined by Spielberger as a trait-anxiety[1].

An orthopaedic injury is a medical condition in which we are dealing with many stress factors, first and foremost as a result of their unexpectedness and suddenness in appearance. The long lasting and unpleasant experience that is a constant pain, together with the sense of uncertainty, will remain, even after being successfully treated, in the memory and will directly influence daily life and a person's functioning[1,2].

Maxey, Ombregt, and Jorge have drawn attention in their works to the states of depression or nervousness appearing in patients treated operationally; states treated as psychic complications[3,4,5]. Individuals with a large fear intensification have a predisposition to these types of complica-tion[5].

OBJECTIVE

The objective of the research was to determine to what the degree a predisposition to anxiety reaction would influence the regaining of muscle strength in patients subjected to an operational reconstruction and post-operational rehabilitation after the anterior crucial ligament (ACL) injury. There arises the research question: does there exist a connection between the intensification of anxiety as a feature and the obtainment of an increase in the muscle strength of the lower limb in patients fol-lowing an operation and rehabilitation after the ACL injury?

MATERIALS AND METHODS

Research group

201 patients operated on at the St. Rafał Hospital in Cracow from 2008 to 2010 due to the ACL injury were examined. The group comprised 113 women (54% of those tested) and 88 men (46%). The age of those observed was between 20 and 39 years of age and was on average 31.9 ±5.5.

Patients were qualified following referral for a reconstructive operation of the ACL following diagnosis of injury as a result of magnetic resonance test results on the knee joint. Excluded from the research were patients for whom the reconstructive operation had been conducted at multiple stages or had involved additional procedures beyond simply ACL reconstruction, surgical treat-ment of the damaged knee joint, as well as excluding those who had not given permission for their inclusion.

Result measurement and measurement instruments

A predisposition to anxiety reaction was measured by means of the Spielberger Questionnaire STAI employing a trait-anxiety scale. The psychological questionnaire of anxiety self-evaluation STAI is an instrument designed to test anxiety understood as a temporary and situationally conditioned state for the individual, and anxiety understood as a relatively permanent trait of personality. The test was carried out once without time limitations with the maintaining of total silence. The evaluation of the results on the basis of a textbook devised by the Psychological Tests Workshop[6], was carried out by two specialists in psychology, with the results being made available to the researchers follow-ing the end of the rehabilitation process.

A division into a group of low, normal and high anxiety was conducted on the basis of the distri-bution of results on a percentage scale, in which the 'norm' referred to those patients who obtained a percentage result within the borders of 5.5 ±2. Following the analysis of results only individuals who were qualified to those groups with a small (less than 3.5) and high (above 7.5) in trait-anxiety intensification were taken into account.

The evaluation of patient muscle strength was conducted at isometric tension. Large groups of muscles of the lower limb were tested on HUR apparatuses by means of a HUR dynamometer performance recorder 9100 Celtron, employing the calculative computer program HUR performance Recorder software Version 2.0. Adduction/Abduction was on HUR 5520 Adduction/Abduction Rehab, bending and straightening of the knee joint on a HUR 5530 Leg Extension/Curl Rehab, while the pressing down of one leg was on A HUR 5545 platform Leg Press Incline Rehab.

The time of isometric tension was 10 seconds for each of the tests, in the course of which the patient was encouraged by the therapist conducting the test to tense the muscle groups to the maximum.

The adduction/abduction isometric test was conducted for both lower limbs simultaneously at knees bent to 45°, in abduction in the hip joint to 15° and bending of 90°. The bending/straightening (extension) test of the knee joint was conducted on one leg in the arrangement of the knee joint at a 60° bend and with the hip joint bent to 90°. For the knee joint bending test the thigh was stabilized by a strap in order for it not to be raised. The leg press test took place on one leg. The patient placed his foot in the centre of the platform, the knee in this test was bent to an angle of 40°, the hip was bent to 100°. The test involved the maximum possible pressure on the platform – it reflected the exercise of a knee bend with one leg.

The tests were conducted under the supervision of a physiotherapist providing the post-operative rehabilitation.

Materials and methods

7 days before the operation for the arthroscopic reconstruction of the knee crucial ligament, patients completed the STAI psychological test as well as tests being conducted on the strength of particular muscle groups of the lower limb.

After the reconstruction of the anterior crucial ligament with the use of autogenic transplant from the gracilis muscle a six-month post-operational period of rehabilitation occurred. The post-operational rehabilitation started during the fourth day after the operation.

In the 24th week of post-operational rehabilitation the testing of muscle strength was repeated.

The rehabilitation programme was based on four phases in the physiological reconstruction of the transplant. Within the framework of the particular phases an active stabilisation was achieved, elasticity of muscle structures, the muscle strength of the lower limb. Initially safe positions in closed kinetic chain exercises (CKC), gradually transferring to open kinetic chain exercises (OKC). In the final stage a proprioception of the knee joint was regenerated so that the transplanted anterior crucial ligaments of the knee were guaranteed muscle stabilization during the period of healing (see the Annex).

Methods of result analysis

There was used in the analysis of the correlation of differences in the average parameters of muscle strength a division of patients into groups employing the formula: $di = x2i - x1i$, where i – the patient number, x1i – the measurement prior to treatment, x2i – the measurement after treatment): increased strength – $di > 0$; an absence in strength increase" – $di =< 0$.

The correlation between belonging to a group of a low or high intensification of trait-anxiety and the obtainment of increased muscle strength was tested by the chi-squared test and the exact Fisher test. Analyses were conducted in the whole group as well as in the subgroups of men and women. Statistical significance was at a level of $p<0.05$.

RESULTS

Amongst patients qualified for operational treatment a trait-anxiety was confirmed on average at a level of 7.6 with a standard deviation of 2.6. There were also individuals within the patient group with extreme values of anxiety, reaching from between 1 and 10 (Table 1).

After the exclusion of those with an average intensification of the trait-anxiety (3.5 to 7.5) it was confirmed that within the analysed group there were 24 patients with a small intensification of the trait-anxiety (20% of those tested) as well as 96 patients with a large intensification of the trait-anxiety (80% of those tested). The results of the division into the two subgroups of men and women are presented in Table 2.

Table 3 presents the average of the values of muscle strength before the operation and after reha-bilitation, in the whole group as well as in the subgroups of men and women.

Table 4 presents the results of testing the correlations of trait-anxiety and changes in muscle strength in the whole group as well as in the subgroups of men and women.

DISCUSSION

The rupture of the anterior cruciate ligament (ACL) constitutes the third most frequent ligament injury of the knee joint[7,8]. This occurs in both sexes, though women are ten times more prone to this type of injury than men.[9,10]

The interest in the psychic sphere of patients operated on is a result of the fact that it has an influ-ence on the final results of treatment. According to Pallister the psychic state of patients should be taken into consideration when classifying them for treatment as well as an element in indi-

Table 1

Average results of the level of trait-anxiety in the whole group and in the female and male groups

Trait-anxiety (%)	n	x ± s	Me	Min–Max
Whole group	201	7.6 ± 2.6	7	1- 10
Men	113	7.2 ± 2.6	8	1- 10
Women	88	7.4 ± 2.6	7	1- 10

Table 2

Number of patient with a low (< 3.5) and high level (> 7.5) of trait-anxiety in the whole group, and according to sex

	Men	Women	In total
Trait-anxiety	N	N	N
Low trait-anxiety	14	10	24
High trait-anxiety	41	55	96

vidualised programmes of treatment[1]. One of the ways of counteracting the appearance of psychic complica-tions is, according to Polinder, the application of post-operational psychological rehabilitation with the aim of raising the state of acceptance of the existing stress situation[11]. Counteraction is addition-ally aided by the active participation of a psychotherapist, who together with a physiotherapist takes part in the process of post-operational rehabilitation, as happens in the case of high-level (profes-sional) sportsmen who have suffered an injury to their legs[12,13]. A significant influence on raising the state of acceptance of a crisis situation is, according to Mang, exerted by patient knowledge on the subject of the treatment procedure in a ruptured ACL[9]. For Kalfos and Muschall a high level of anxiety is a reason for the lowering in the effectiveness of convalescence[14,15].

Often psychic complications, particularly neurotic disorders, may manifest themselves at a later period in the form of increased somatic symptoms. These complications are referred to in medi-cine as psychosomatic, which means psychic problems resulting from an extension of somatic problems. Initially problems of this type involved the experiencing of symptoms of an inadequate intensity in relation to the actual clinical state[15]. Factors increasing the risk of the appearance of psychosomatic complications include also in addition coexisting long-term stress and a lack of the ability to cope with it. The appearance of stress may be connected with the very fact of an opera-tion, the extended pain situation, or a socio-existential situation - something that has been noted by Wall and Morales in their works[5,16]. Wall also mentions additional factors intensifying the al-ready existing stress assembled in a group of confounding variables[16].

According to Carlson there belong to earlier complications resulting from psychosomatic ortho-paedic injuries: sympathetic dystrophy (1% of all complications), nerve-muscle damage (less than 1%), inflammation of deep set DVT veins, infections and bleeding[17]. Later complications include: artrofibrosis, excessive lateral pressure syndrome (SRU), patellofemoral pain syndrome[3,4,17]. There should be included in psychosomatic complications of a lesser somatic consequence: joint stiffness; muscle weakness; knee touch sensitivity (in the case of taking a graft/transplant from the knee ligament BPTB); the absence of a full range of movement (particularly in hyperextension) in the knee joint[18,19]. In the data given above there were excluded any causes of symptoms other than psy-chic ones.

A direct influence of a low level of anxiety on convalescence processes was not found. However, tendencies appear in this type of patient to undertake a large degree of risk which has health conse-quences in the form of frequent, repeating and extensive injuries to the organs of movement. Ac-cording to Neeter, patients with a low level of anxiety often do not adhere to the instructions of therapists and doctors, meaning that in the post-operative period they expose themselves to compli-cations in the form of overloading symptoms[20]. Often patients with a low level of anxiety terminate post-operational therapy before its completion, delaying or reducing the effects of treatment. For this type of patient, according to Nickinson, a solution can be hospital based rehabilitation, under the constant control of medical staff[21], or an increased frequency in therapeutic sessions in out-patients' clinics, up to five times a week until the passing of the risk of a return in ACL severance at those periods of a weakened graft/transplant resistance i.e., up to around the 12th week[21].

In our results patients most often obtained an average of trait-anxiety of 7.6, something that is within the normal distribution occurring in a healthy population sample (5.5 +/-2)[6,22]. Patients in the test with a high level of fear did not have, besides a small rate of muscle strength increase and a weaker evaluation of their own state of health, complications of a psychosomatic disease nature.

According to Gage[23] and Wrześniewski[6] patients with a high level

Table 3

Changes of muscle strength after ACL rupture treatment in patients with low, medium and high levels of trait-anxiety

Tested muscle groups and the Leg Press test	Muscle strength x [N]		
	Testees with a high intensification of the trait-anxiety (>7.4)	Testees with an average intensification of the trait-anxiety (3.5 – 7.4)	Testees with a small intensi-fication of the trait-anxiety (< 3,5)
	The whole group		
Abductors	4.8 ±18.3	17.8± 13.2	18.4 ± 27.0
Adductors	-2.6 ±36	19.6± 16.3	18.3 ± 24.9
Flexors	36.9±34.3	54.8 ± 28.7	47.9 ± 36.6
Extensors	33.7 ± 69.6	75.2 ± 54.4	93.6 ± 75.8
Test Leg Press	88.0±131.5	169± 69.0	153± 88.0
	Men		
Abductors	6.7 ±18.0	18.5 ± 19.4	24.6 ± 27.8
Adductors	0.5 ± 26.2	26.7 ± 28.7	17.4 ± 43.4
Flexors	38.4 ± 48.5	57.6 ± 36.8	53.8 ± 42.4
Extensors	39.8 ± 87.9	135.7 ± 48.6	166.8 ± 69.6
Test Leg Press	115 ± 124.6	202.5 ±104.5	113.7 ± 103.0
	Women		
Abductors	3.5 ±17.8	18.4 ±6.9	17.7 ±19.6
Adductors	-1.4 ±22.6	15.4 ± 7.9	21.5 ±25.2
Flexors	32.2 ±34.6	69.7 ±12.5	37.3 ± 34.6
Extensors	24.4 ±79.3	58.3 ±19.5	69.6 ± 58.5
Test Leg Press	97.2 ±131.0	169 ±90.5	155.3 ± 125.0

Table 4

Value p verification interdependence of trait-anxiety and muscle strength in the lower limb in the whole test group, and the male and female groups

		Small intensification of the trait-anxiety (<3.5) [%]	Large intensification of trait-anxiety (>7.4) [%]	Results of analysis of the correlation value p
			Whole test group	
Abductor group	force increase	64.6	83.3	0.280
	no force increase	35.3	16.7	
Adductor group	force increase	91.7	19.2	0.014
	no force increase	8.3	80.8	
Flexor group	force increase	78.3	92.5	0.827
	no force increase	21.7	7.5	
Extensor group	force increase	89.2	7.5	0.016
	no force increase	10.8	92.8	
Test Leg Press	force increase	100.0	5.8	0.015
	no force increase	0.0	94.2	
			Men	
Abductor group	force increase	81.8	63.6	0.562
	no force increase	18.2	36.4	
Adductor group	force increase	81.8	25.5	0.012
	no force increase	18.2	74.5	
Flexor group	force increase	100.0	90.9	0.766
	no force increase	0.0	9.1	
Extensor group	force increase	100.0	0.0	<0.001
	no force increase	0.0	100.0	
Test Leg Press	force increase	100.0	3.6	0.003
	no force increase	0.0	96.4	
			Women	
Abductor group	force increase	74.5	100	0.505
	no force increase	25.5	0.0	
Adductor group	force increase	100	13.8	0.010
	no force increase	0.0	86.2	
Flexor group	force increase	60.0	93.8	0.668
	no force increase	40.0	6.2	
Extensor group	force increase	80.0	13.8	0.010
	no force increase	20	86.2	
Test Leg Press	force increase	100.0	7.7	0.014
	no force increase	0.0	92.3	

of anxiety far more often than those with a low level are, in stressful situations such as operations[21], susceptible to the appearance of psychic disturbances such as depression and neurosis[5]. The appearance of this type of disorder doubly influences the slowing down of patient improvement and the development of psychosomatic illnesses[3,4]. In our tests patients with a high level of trait-anxiety more often obtain a lower muscle force in the leg press test 94.0% of the tested extensors of the treated knee joint – 92.8% of those examined, and also the muscle strength of the adductors of the hip joint (80.6%) as a result of ACL terminated treatment. In the group with a low trait-anxiety there was an absence of individuals with a deterioration in muscle strength/force at the leg press test and knee joint extensors as a result of terminated ACL treatment. In this group a significant percentage was also the group with an im-provement in the strength of the tested adductors. According to the research of Langen and Morales, a high level of anxiety influences the slowing down of improvement, including also a lowering in muscle strength[5,24]. Langen also emphases the important influence of a positive approach to reha-bilitation on the part of the patient, to stimulate the healing processes of the immune and regenera-tive system[24].

The taking up of challenges in the form of completing more complex and risky exercises consti-tutes the next factor psychic in nature which is dependent on the level of anxiety. Amongst exer-cises of an increased level of risk should be included chiefly proprioceptive exercises, being key in increasing the active stabili-

sation of the knee joint. In patients with a high level of anxiety there is observed an absence of a positive approach to treatment as well as a limited involvement in the re-habilitation process. This manifests itself in the carrying out of home-based exercises. Patients with an extremely low, as equally those with an extremely high, level of anxiety have problems with this element of therapy. According to Zaffagnini, van Grinsven and Morales, this is also significant during the period of a return to health on the part of patients with an injury to the motor sys-tem[5,25,26].

CONCLUSIONS

An increased predisposition to an anxiety reaction, evaluated on a trait-anxiety scale from the Spiel-berg Questionnaire, is connected with the frequent absence of progress in the increase in muscle strength during the course of rehabilitation following operational arthroscopic treatment of an an-terior crucial ligament injury.

Patients with an increased predisposition to a anxiety reaction should be covered by an individual tailor-made programme of rehabilitation incorporating psychotherapy.

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Appendix: 6-month rehabilitation program														
Exercises	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**13**	**17**	**21**	**24**
Cocontraction hamstring/quadriceps when seated	X	X												
Cocontraction hamstring/quadriceps when standing		X	X	X	X	X								
Knee bending with cocontraction – both legs						X	X	X	X	X				
Knee bending with cocontraction – one legged									X	X	X	X	X	X
Isometric VMO with a ball	X	X	X	X	X									
Proprioception in one legged – unloaded		X	X	X	X									
Proprioception – both legs						X	X	X	X	X				
Proprioception – one legged									X	X	X	X	X	X
VMO electrostimulation with exercises	X	X	X	X	X	X								
Sole bending on a band – the knee at a 60° bend	X	X												
Sole bending on a band – with a straight-ened knee			X	X	X	X								
Extension/bending sliding on the wall	X	X	X	X	X	X								
Knee arthromot K2± optional	X	X	X											
Extension/ bending on the HUR Leg Press device							X	X	X	X	X	X	X	X
Strengthening the quadriceps muscles OKC on the HUR device – both legs								X	X	X	X	X	X	X
Strengthening the ischio-crural muscles OKC on the HUR device							X	X	X	X	X	X	X	X
Strengthening the adductors and middle gluteal muscle on the HUR device														
Standing on one's toes			X	X	X	X	X	X	X	X				
Stretching the calf/ ischio-crural muscles	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stretching the quadriceps/ adductors/ glu-teal muscles														
Strengthening/stretching of the muscles of the tarsal and hip joints	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Orthopaedic equipment														
Long stabiliser	X	X	X	N	N	N								
Crutches	X	X												
Massage and manual techniques														
Cicatrix mobilization		X	X	X	X	X	X	X	X	X	X			
Oedema drainage	X	X	X	X	X	X								
Fascial techniques	X	X	X	X	X	X	X	X						
Mobilisation of knee hyperextension								X	X	X	X	X		
Mobilisation of knee bending	0	30	60	60	90	90	10	12	12	12	12	Max		
Cooling of the knee – around 0°C	X	X	X	X	X	X	X	X	X	X	X			
Daily activities														
Burdening of the limb	K	K	O	O	O	O	J,W	J,W	W	S	S	Max	Max	Max
Way of moving about	C	C	C	C	C	C	C	C	C	B	B	Sk	Sk	Sk
Return to work						Si			Si/ ST	St				Tr
Driving a car++						X	X	X	X	X	X	X	X	X
Complex activities														
Cycling±±								X	X	X	X	X	X	X
Running on a treadmill											X	X	X	X
Swimming**										X	X	X	X	X
Gym												X	X	X
Sport generally comprehended													X	X

X – in this week we start the given activity; VMO – the medial head of the quadriceps muscle; OKC (open kinetic chain) – muscle labour in an open chain; the HUR device (apparatus) – a device for isotonic eccentric/ coaxial ex-ercises based on given pressure; N – for the night, with a movement scope of 0° for bending and extension; mobilisation of bending – in degrees, the range permissible for a given scope; Max – without limitations; K – walking with crutches; O – full burdening on both legs; J – full burdening on one leg; W – taking stairs without bringing up the foot (alternating); S – coming down stairs alterna-ting; C – walking, gradually, on a flat surface and in turn on an incline; B – running, gradu-ally, on the spot on a trampoline, on a flat and inclined surface; Sk – jumping, gradually, with both legs then one legged; Si – work with a dominance for a sitting position; St – standing and physical work; Tr – for professional sportsmen a return to training

+ the property of a motor unit to react not changing the environment conditions at the micro-movement level; protecting the joint from injury on an unsta-ble ground or during dynamic move-ments; ± a machine for passive bending of the knee comprising the full support of the thigh and shank; ++ for cars with an automatic gearbox there is the possibility for those with an operated on left knee to drive earlier; ±± not recommended in the course of rehabilita-tion as a result of the nega-tive effect on the timing of the kneecap and the patellar-hip joint; ** a ban on breast stroke for 7 months after the operation